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REMINISCENCES OF WILLIAM LENHART ESQ.

BY PROFESSOR DANIEL KIRKWOOD.

Dr. Hart's interesting "Historical Sketch of American Mathematical Periodicals" in the last No. of the ANALYST, makes honorable mention of my quondam friend, Mr. William Lenhart, the eminent mathematician. This reference has revived some of the most pleasant recollections of my youth. In 1838, when a tutor in the York County Academy, at York, Pennsylvania, I became acquainted with Mr. Lenhart, who was then, and had been for many years, an invalid, spending his summers in York, and his winters in Frederick, Maryland. He was a great enthusiast in his mathematical researches and having been without the sympathy of kindred minds, in York at least, he seemed gratified to find any one who was interested in his favorite studies. Mr. L., who was then over 50 years of age, related with much frankness the chief incidents of his eventful life, some of which may be found in the Princeton Review for July, 1841.

The mathematical talents of William Lenhart were first developed under the instruction of Mr. (afterward Dr.) Robert Adrain. About the year 1800 Mr. A., then a young man but little known, was chosen Principal of the York County Academy. William Lenhart, at the age of 13, became his pupil. The teacher at once noticed the splendid abilities of the student, and gave him more than ordinary attention and encouragement. William's father, however, had but little appreciation of mathematical learning, and withdrew him from school after an attendance of only 18 months. His subsequent attainments were entirely the result of his own unaided efforts

Dr. Hart in his list of writers for the *Mathematical Diary* names "Mary Bond, of Fredericktown, Md., the only female contributor." The solutions under that name, as well as one or two under that of *Diophantus*, were all by Mr. Lenhart. Of this fact I was informed by Mr. L. himself. He sometimes obtained quite different solutions of the same question, and in order to have both published sent one under an assumed signature.

Mr. Lenhart's library was very small. He showed me his books and manuscripts with great interest. Barlow's Theory of Numbers, The Ladies' Diary, from its commencement in 1704, The Mathematical Journals published in our own country, Euler's Algebra, and a few other mathematical works, are all now remembered. His manuscripts were the neatest I have ever seen, and some of them were handsomely bound in Morocco and gilt. He read to me a number of letters from Professor C. Gill, (Editor of the Mathematical Miscellany,) by whom the Diophantine speculations of Mr.

L. were published. In one of these letters it was affirmed that Mr. Lenhart had done more for the Diophantine Analysis than any other man that had ever lived. In another, Professor G., after expressing a desire to publish Lenhart's tables relating to squares and cubes, remarked that the printing would be attended with no inconsiderable expense. Mr. L., who was an inveterate smoker, at once, as he informed me, gave up his cigars, and appropriated the money thus saved to meet the expense of publication.

Of the distressing accident by which Mr. Lenhart, when a young man, was maimed for life, of the consequent blighting of his temporal prospects, and the intensity of his physical sufferings during a period of 28 years, it is unnecessary to speak, as the circumstances are detailed at some length in the article to which I have already referred. He died at Frederick, Md., on the 10th of July, 1840.

ON SUPPLYING OMISSIONS IN A CLOSED SURVEY.

BY CLEVELAND ABBE, WASHINGTON, D. C.

The problem of supplying any omissions in a closed survey which is treated by Prof. Philbrick in the ANALYST, p. 116, is one that I had occasion to explain more fully than is done in Gillespie's Treatise, while teaching the engineering students, in 1859, at Ann Arbor. A portion of my analytical solution of the problem was published, in 1861, in the Journal of the Franklin Institute, by Prof. DeVolson Wood with valuable additions by himself; and as it may be interesting to surveyors to look at the subject from this as well as the geometrical point of view, I will add the following to what Professors Wood and Philbrick have written.

Let the ordinary bearings (x) of the sides be converted into azimuthal angles by the following rules:

$N.\ x^\circ\ E.$ becomes azimuth x°; $S.\ x^\circ\ E.$ becomes azimuth $180^\circ - x^\circ$;
$N.\ x^\circ\ W.$ " " $360^\circ - x^\circ$; $S.\ x^\circ\ W.$ " " $180^\circ + x^\circ$;

the converse of which need not be repeated here.

Let the known sides be a_1, a_2, &c.; the known azimuths, b_1, b_2, &c.;
" unknown " " x_1, x_2, &c.; " unknown " y_1, y_2, &c.

The sides being always considered as positive numbers, the general equations of condition in a perfect survey are

$$\Sigma\ \text{Dep.} = a_1 \sin b_1 + a_2 \sin b_2 + a_3 \sin b_3\ \text{\&c.} = 0,$$

$$\Sigma\ \text{Lat.} = a_1 \cos b_1 + a_2 \cos b_2 + a_3 \cos b_3\ \text{\&c.} = 0.$$

From which any two quantities, if unknown, may be found by elimination.